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(54) **TOUCH STRUCTURE AND MANUFACTURING METHOD FOR THE SAME**

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H05K 1/02 (2006.01)
H05K 3/46 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 3/044*** (2013.01); *Y10T 29/49165* (2015.01); ***H05K 1/0289*** (2013.01); ***H05K 3/4685*** (2013.01)

(58) **Field of Classification Search**
CPC G06F 3/44; H05K 1/0289; H05K 3/4685
See application file for complete search history.

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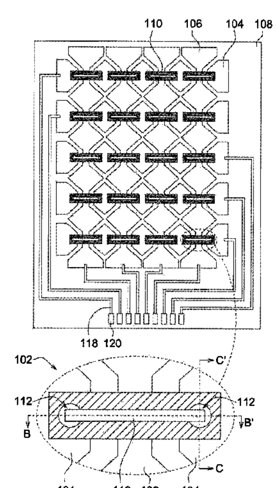
(57) **ABSTRACT**

A touch structure and a manufacturing method for the same are provided. The touch structure comprises first patterned electrodes, a second patterned electrode, a dielectric structure and a conductive bridge. The second patterned electrode is disposed between the first patterned electrodes, and separated from the first patterned electrodes. The dielectric structure is disposed on the first patterned electrodes and the second patterned electrode. The dielectric structure has a dielectric opening. The conductive bridge is disposed across the dielectric structure and extended in the dielectric opening. The first patterned electrodes are electrically connected to each other through the conductive bridge.

10 Claims, 8 Drawing Sheets



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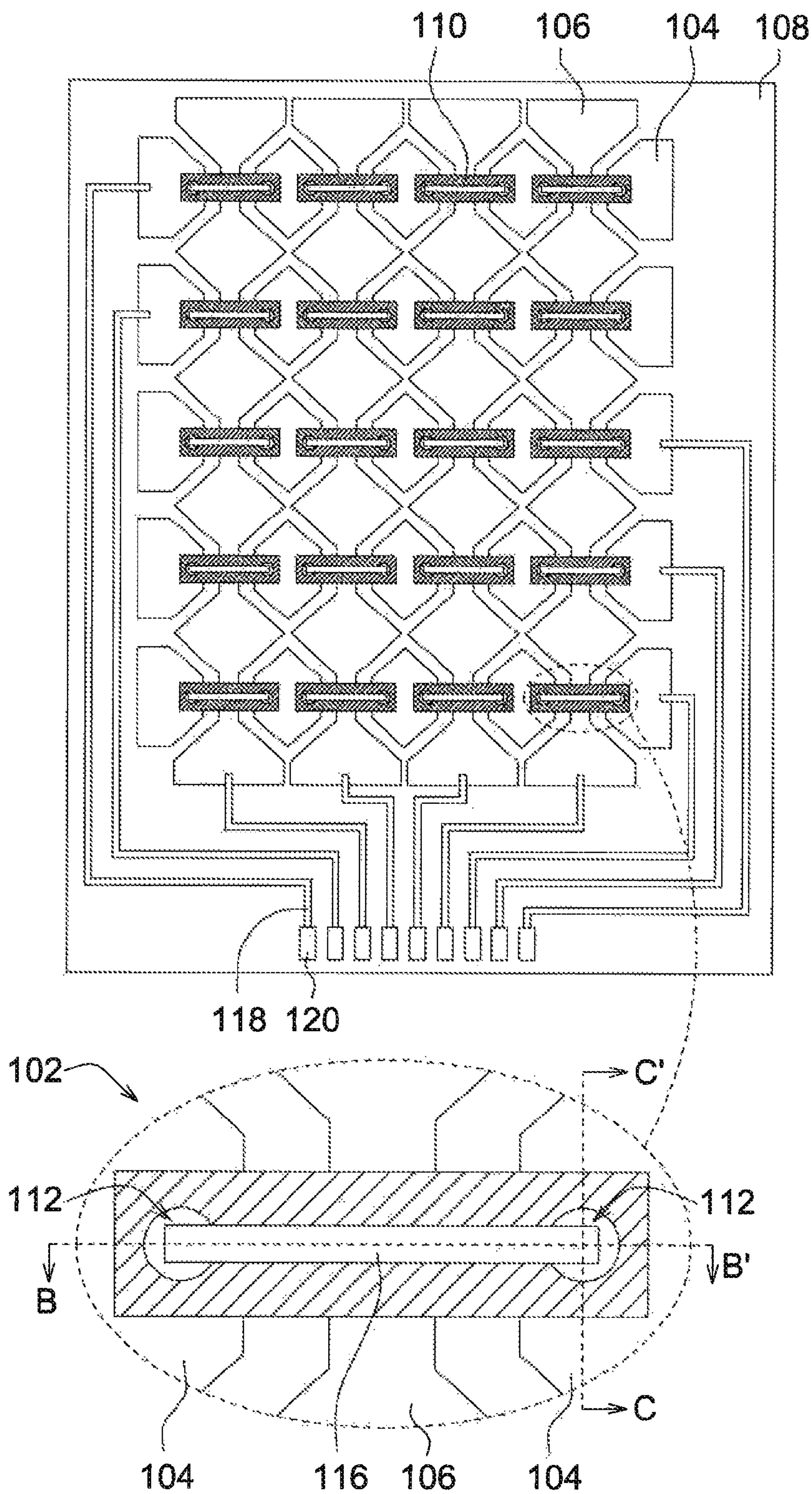

FIG. 1A

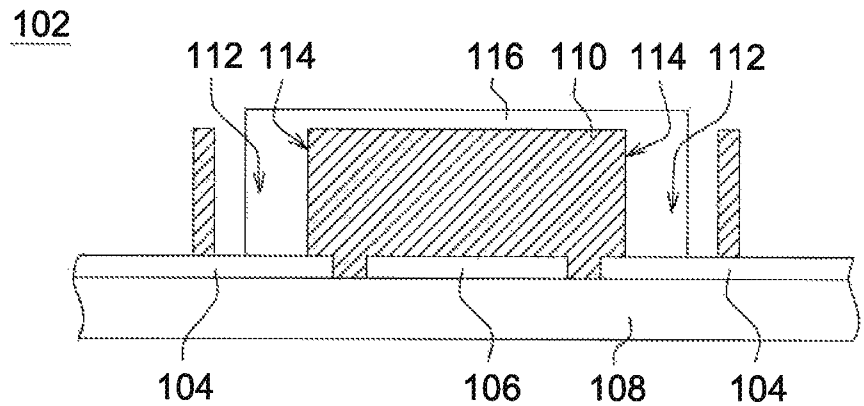
102
112 114
116 110 114 112
104
106 108 104

FIG. 1B

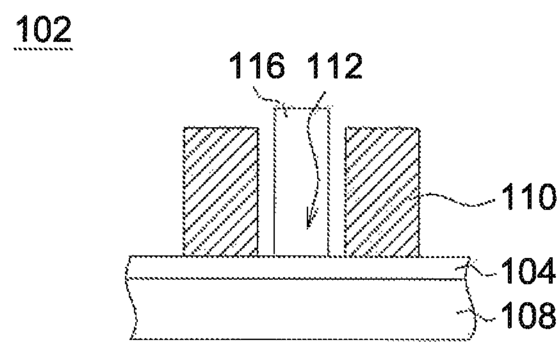
102
116 112
110
104
108

FIG. 1C

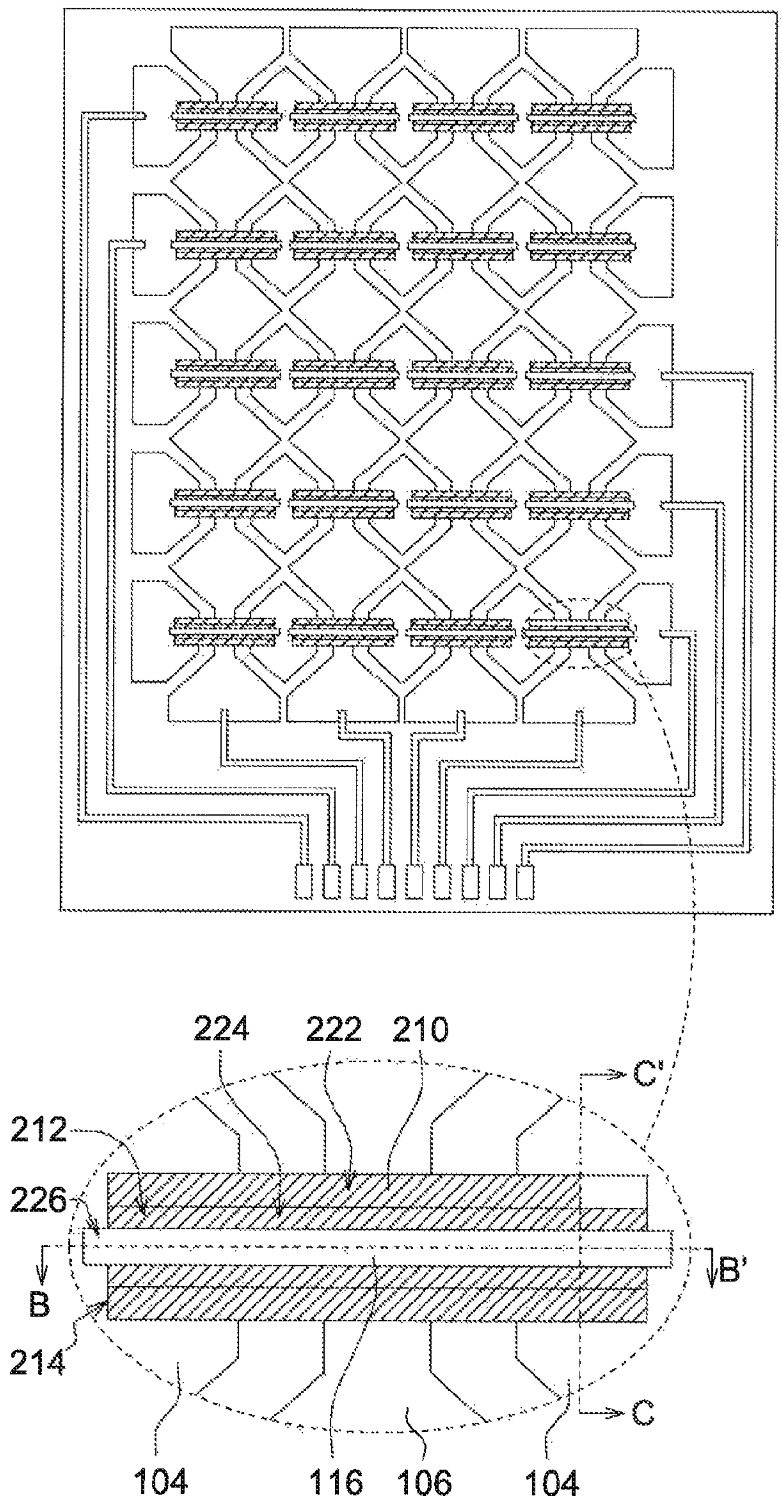

FIG. 2A

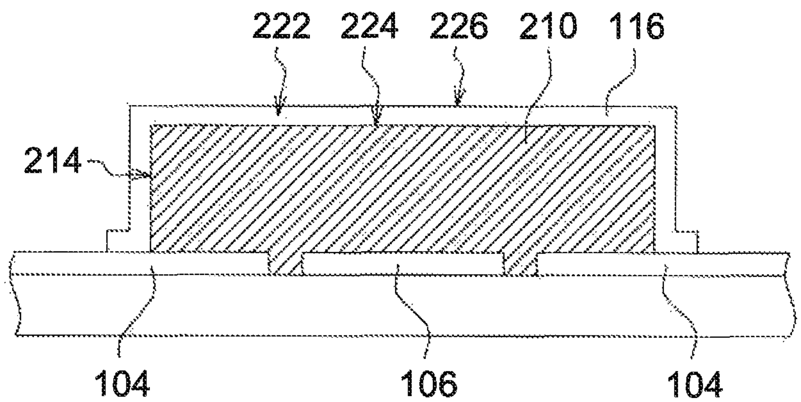

FIG. 2B

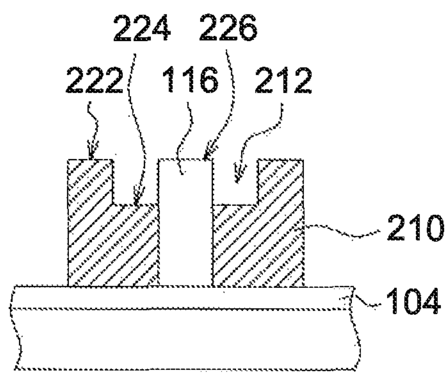

FIG. 2C

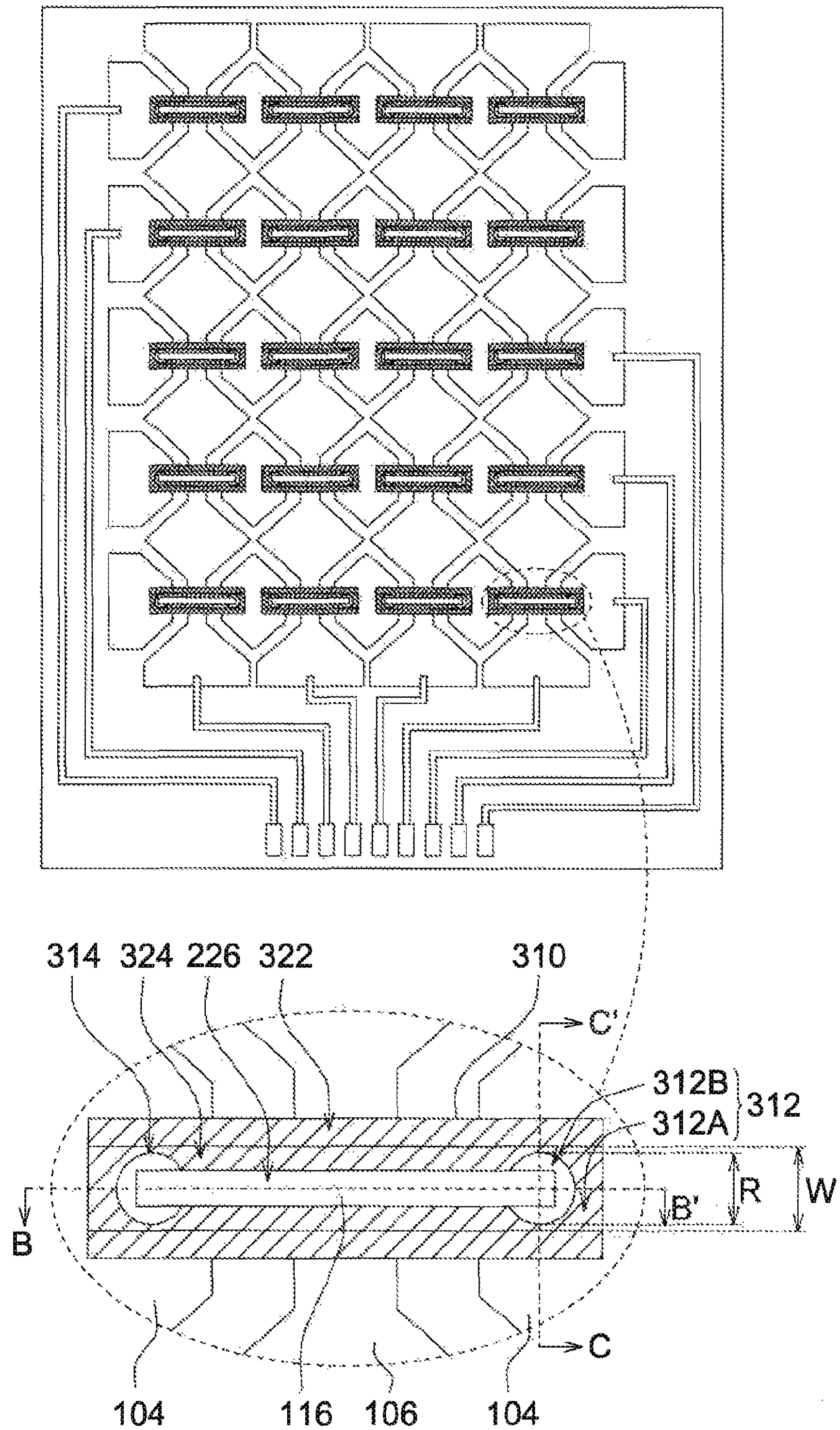

FIG. 3A

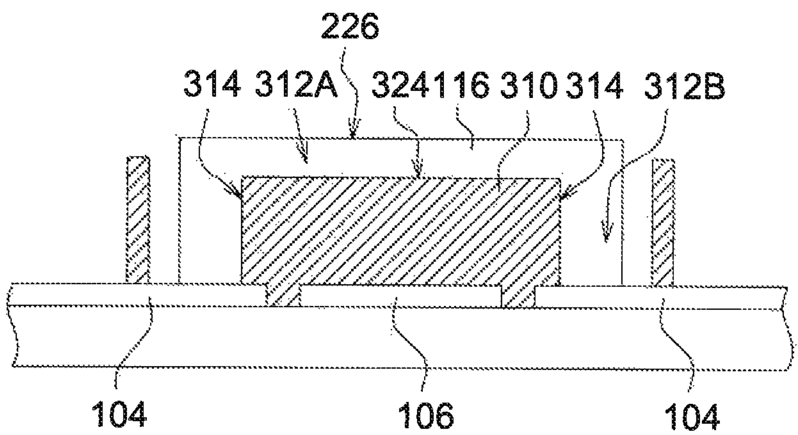
226
314
312A
324
116
310
314
312B
104
106
104

FIG. 3B

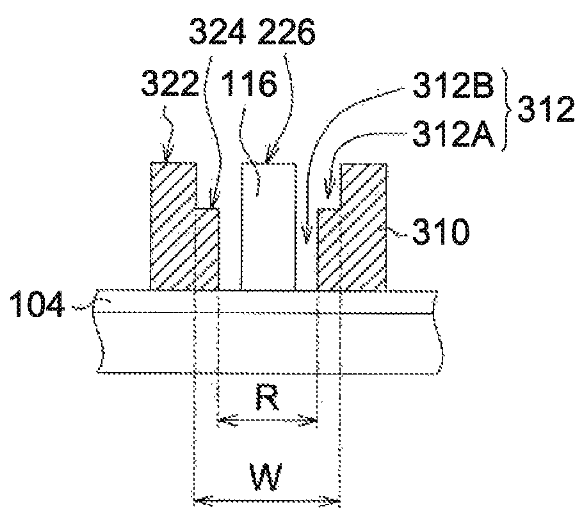
324
226
322
116
312B
312
312A
310
104
R
W

FIG. 3C

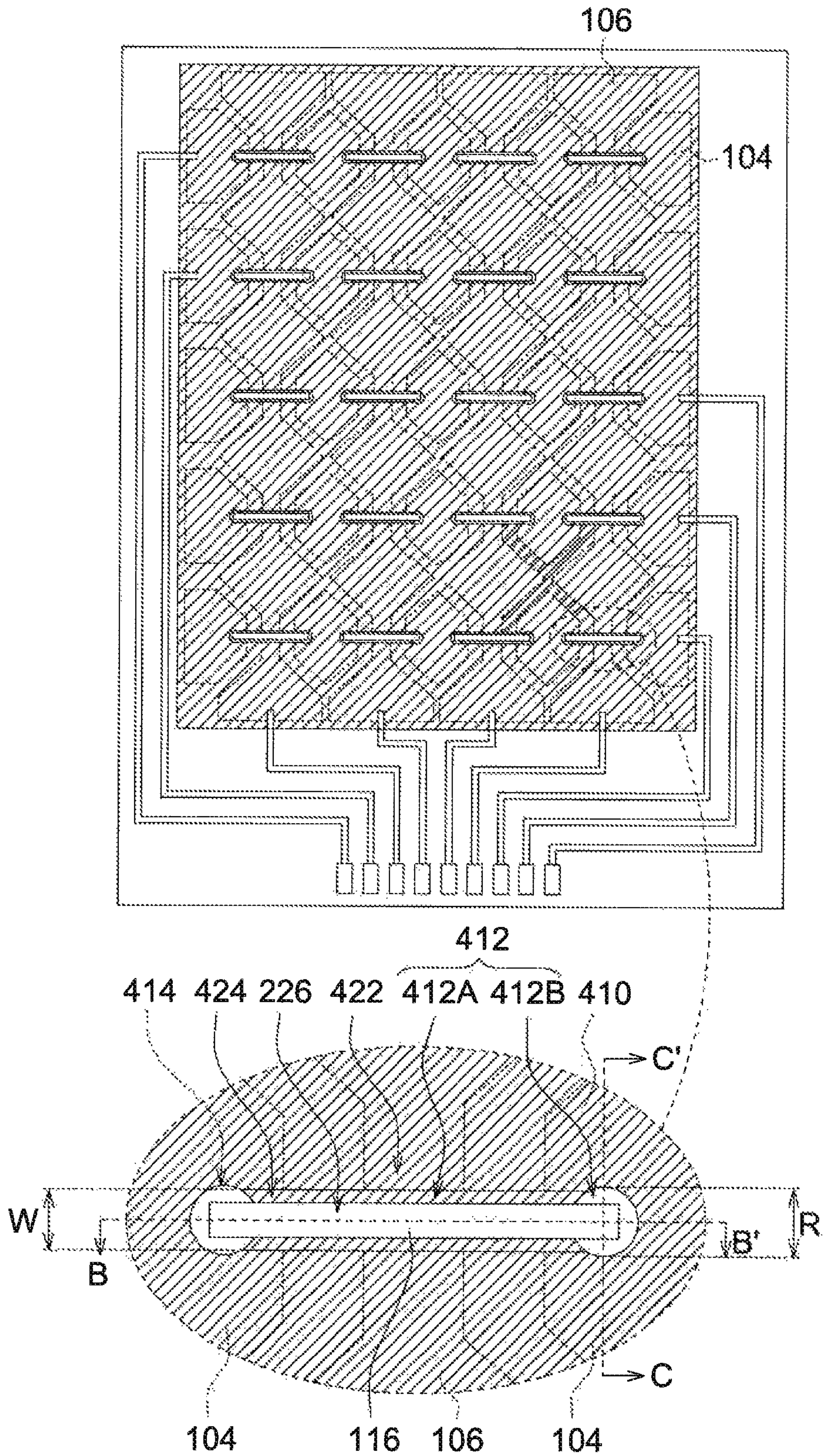
106
104
412
414
424
226
422
412A
412B
410
C'
W
B
B'
R
C
104
116
106
104

FIG. 4A

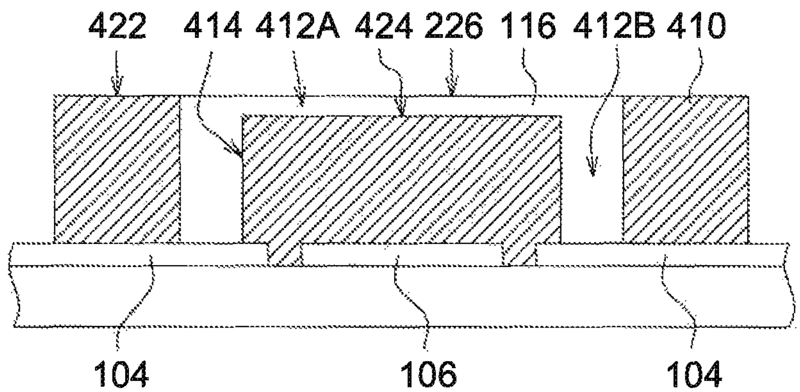
422
414
412A
424
226
116
412B
410
104
106
104

FIG. 4B

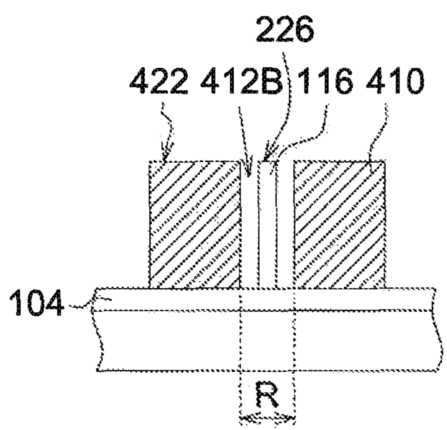
226
422
412B
116
410
104
R

FIG. 4C

TOUCH STRUCTURE AND MANUFACTURING METHOD FOR THE SAME

This application claims the benefit of Taiwan application Serial No. 101141603, filed Nov. 8, 2012, the disclosure of which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

The disclosure relates in general to a touch structure and a manufacturing method for the same, and more particularly to a touch structure whose dielectric structure has a dielectric opening and a manufacturing method for the same.

BACKGROUND

The future display technology is directed towards more user friendly man-machine interface. Conventional panel operation relies on mechanical buttons. As flat display is getting more and more popular, touch panel has become a mainstream product which replaces other input device such as keyboard and mouse and makes the use of information products easier and more conveniently. Therefore, the age of touch panel which is easy to operate has come. Touch panel can be used in various products such as vehicle touch panel (vehicle navigator), game machine, public information system (such as vending machine, automatic teller machine (ATM), navigation system), industrial purpose information products, small electronic products (such as personal digital assistant (PDA)), e-book. The competition in the display industry is intense, and main players comprise Japan, Taiwan, Korea and China. Almost global main manufacturers in the display industry are proactively engaged in the research and development of the touch panel technology, and the market demand is expected to experience significant growth in the coming years.

Along with the popularity of iPhone, global sale of smart phones increases rapidly, and the market potential in the hardware and application services of the smart phones cannot be underestimated. Therefore, the breakthrough in the projected capacitive touch panel has attracted more and more manufacturers' interest in the research and development in multi-touch technology and the production of the products using the same. The research and development in the industries are now focused on the elevation of the operating efficiency of the touch structure.

SUMMARY

According to one embodiment, a touch structure is provided. The touch structure comprises first patterned electrodes, a second patterned electrode, a dielectric structure and a conductive bridge. The second patterned electrode is disposed between the first patterned electrodes, and separated from the first patterned electrodes. The dielectric structure is disposed on the first patterned electrodes and the second patterned electrode. The dielectric structure has a dielectric opening. The conductive bridge is disposed across the dielectric structure and extended in the dielectric opening. The first patterned electrodes are electrically connected to each other through the conductive bridge.

According to another embodiment, a manufacturing method of a touch structure is provided. The method comprises following steps. First patterned electrodes are disposed on the substrate. The second patterned electrode is disposed on the substrate. The second patterned electrode is disposed

between the first patterned electrodes. The dielectric structure is disposed on the first patterned electrodes and the second patterned electrode. A dielectric opening is formed in the dielectric structure. The conductive bridge is disposed across the dielectric structure and extended in the dielectric opening. The first patterned electrodes are electrically connected to each other through the conductive bridge.

The above and other aspects of the disclosure will become better understood with regard to the following detailed description of the non-limiting embodiment(s). The following description is made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A shows an upper view of a touch structure according to one embodiment;

FIG. **1**B shows a cross-sectional view of a touch structure according to one embodiment;

FIG. **1**C shows a cross-sectional view of a touch structure according to one embodiment;

FIG. **2**A shows an upper view of a touch structure according to one embodiment;

FIG. **2**B shows a cross-sectional view of a touch structure according to one embodiment;

FIG. **2**C shows a cross-sectional view of a touch structure according to one embodiment;

FIG. **3**A shows an upper view of a touch structure according to one embodiment;

FIG. **3**B shows a cross-sectional view of a touch structure according to one embodiment;

FIG. **3**C shows a cross-sectional view of a touch structure according to one embodiment;

FIG. **4**A shows an upper view of a touch structure according to one embodiment;

FIG. **4**B shows a cross-sectional view of a touch structure according to one embodiment;

FIG. **4**C shows a cross-sectional view of a touch structure according to one embodiment.

In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

DETAILED DESCRIPTION

FIG. **1**A shows an upper view of a touch structure according to one embodiment. FIG. **1**B shows a cross-sectional view of the touch structure of FIG. **1**A along BB' line. FIG. **1**C shows a cross-sectional view of the touch structure of FIG. **1**A along CC' line. In one embodiment, the touch structure is a projection capacitive touch structure.

Referring to FIG. **1**A to FIG. **1**C, the touch structure comprises sensing units **102**. First patterned electrodes **104** and second patterned electrodes **106** are disposed on a substrate **108**. The first patterned electrodes **104** and the second patterned electrodes **106** are separated from each other. The substrate **108** may comprise a flexible base material or a rigid base material. The flexible base material may comprise polyethylene terephthalate, polycarbonate, a flexible glass or other suitable materials. The flexible base material may comprise single-sheet base material or rolled base material. The rigid base material may comprise a rigid glass or other suitable materials.

The second patterned electrode **106** is disposed between the first patterned electrodes **104**. For example, the first patterned electrodes **104** separated by the second patterned electrode **106** are arranged along a first direction. The second patterned electrode **106** is extended in a second direction different from the first direction. In one embodiment, for example, the first direction is the X-axial direction, and the second direction is the Y-axial direction.

The first patterned electrodes **104** and the second patterned electrode **106** can be formed by patterning a conductive film (not illustrated) formed on the substrate **108**. The conductive film may comprise metal or other suitable materials. For example, the conductive film may comprise a transparent material and so on. The conductive layer **126** may comprise such as inorganics or organics and so on. The inorganics may comprise oxides such as ITO, FTO, ZnO, AZO, IZO and so on. For example, the organics may comprise conductive/conjugated polymer, nanometer metal, carbon nanotubes, graphene, and nanometer silver line and so on. The conductive film may comprise single transparent conductive layer (single ITO; SITO), double transparent conductive layers (double ITO; DITO), one glass solution (OGS) glass, or conventional touch on lens (TOL). The conductive film can be formed by a deposition process such as a vacuum coating process, a printing process such as R2R process, or other suitable methods. The patterning step comprises a photolithographic process. In some embodiments, the first patterned electrode **104** and the second patterned electrode **106** may be formed by a printing process without using a patterning process. The printing process does not require a series of complicated procedures of thin film deposition and photolithographic etching, hence largely simplifying the process, shortening production time and increasing production. The first patterned electrode **104** and the second patterned electrode **106** may comprise metal or other suitable materials. For example, the first patterned electrode **104** and the second patterned electrode **106** may comprise transparent conductive oxides, organic transparent conductive materials or carbon nanotubes and so on.

In one embodiment, for example, the first patterned electrodes **104** and the second patterned electrode **106** are disposed on the same plane of the substrate **108**, hence largely reducing hollowing ratio and top/down alignment caused from a double-layered conductive film of a structural design to the first patterned electrode **104** and the second patterned electrode **106**, and obtaining better imaging effect and higher sensitivity and precision. In addition, the structural design using a single-layered conductive film can achieve lightweight and thinness at the same time.

A dielectric structure **110** is disposed on the first patterned electrode **104** and the second patterned electrode **106** separated from each other. In the example, the dielectric, structure **110** covers partial of the first patterned electrode **104** and the second patterned electrode **106**. The dielectric structure **110** has a dielectric opening **112** formed therein. In the example, the dielectric openings **112** are dielectric holes respectively exposing the corresponding first patterned electrodes **104** and dielectric sidewalls **114** (FIG. **1**B).

The dielectric structure **110** having the dielectric opening **112** can be formed by patterning a dielectric thin film (not shown) formed on the first patterned electrode **104** and the second patterned electrode **106**. The dielectric thin film may be formed by a deposition process such as a vacuum coating process, a printing process such as R2R process, or other suitable methods. The patterning step comprises the photolithographic etching process. In some embodiments, the dielectric structure **110** having the dielectric opening **112** may be directly formed by a printing process without using a patterning process. The printing process does not require a series of complicated procedures of thin film deposition and photolithographic etching, hence largely simplifying the process, shortening production time and increasing production. The dielectric structure **110** comprises a dielectric material, comprising a resin, etc., such as a photosensitive resin or a thermosetting resin, or an inorganic transparent dielectric insulating material such as silica.

In the example, a conductive bridge **116** is disposed across a partial of the dielectric structure **110** and is extended on the dielectric sidewall **114** exposed from the dielectric opening **112** (that is, the dielectric hole) for electrically connecting the first patterned electrodes **104** separated by the second patterned electrode **106** to each other. In one embodiment, the conductive bridge **116** may fully fill the dielectric opening **112** substantially. The conductive bridge **116** may be formed by patterning a conductive film (not shown) formed on the dielectric structure **110**. The conductive film may be formed by a deposition process such as a vacuum coating process, a printing process such as R2R process, or other suitable methods. The patterning step comprises a photolithographic etching process.

In some embodiments, the conductive bridge **116** may be directly formed by a printing process without using a patterning process. The printing process does not require a series of complicated procedures of thin film deposition and photolithographic etching, hence largely simplifying the process, shortening production time and increasing production. In addition, since the dielectric structure **110** has the dielectric opening **112** (that is, the dielectric hole), a printing conductive glue for the conductive bridge **116** can be precisely controlled and guided into the dielectric opening **112** to form excellent electrical connection with the first patterned electrode **104** in the conductive structure. Therefore, the short-circuiting problem caused from the conductive glue being overbanked to unexpected areas such as the short-circuiting between the adjacent first patterned electrode **104** and second patterned electrode **106** can be avoided, and the conductive bridge **116** can have better electrical properties or physical qualities such as uniform width and thickness.

The conductive bridge **116** may comprise metal or other suitable materials. For example, the conductive bridge **116** may comprise a metal-containing material, such as a conductive silver paste, a copper-containing metal, or a multi-layered material containing molybdenum, aluminum, and molybdenum. The conductive bridge **116** may comprise a transparent conductive ink. The transparent conductive ink comprises a metal oxides material, an organic transparent conductive material or a transparent conductive material with a mixture of organics and inorganics.

In one embodiment, for example, the first patterned electrode **104**, the second patterned electrode **106**, the dielectric structure **110** and the conductive bridge **116** are not limited to be formed by the same manufacturing method such as the printing method or the method used for patterning a thin film. The choice of the manufacturing method can be based on the selection of materials and equipment as well as the consideration of cost.

As indicated in FIG. **1**A, the first patterned electrodes **104**, the second patterned electrodes **106** and the conductive bridges **116** form a matrix structure. The first patterned electrodes **104** and the second patterned electrodes **106** may be coupled to touch terminals **120** through conductive connection wires **118** to form a projection capacitive touch sensing element. The conductive connection wires **118** may comprise a metal-containing material. The metal-containing material may comprise a conductive silver paste, a copper-containing metal or a multi-layered material formed by molybdenum, aluminum, and molybdenum, or other suitable materials.

FIG. 2A shows an upper view of a touch structure according to one embodiment. FIG. 2B shows a cross-sectional view of the touch structure of FIG. 2A along BB' line. FIG. 2C shows a cross-sectional view of the touch structure of FIG. 2A along CC' line. The touch structure of FIG. 2A to FIG. 2C is different from the touch structure of FIG. 1A to FIG. 1C in that the dielectric opening **212** of the dielectric structure **210** is a dielectric trench. The dielectric structure **210** has a first upper dielectric surface **222** and a second upper dielectric surface **224**. The dielectric opening **212** (that is, the dielectric trench) is extended towards the inside of the dielectric structure **210** from the first upper dielectric surface **222** and exposes the second upper dielectric surface **224**. In other words, the first upper dielectric surface **222** is higher than the second upper dielectric surface **224**. The conductive bridge **116** is extended on the second upper dielectric surface **224** exposed from the dielectric opening **212** (that is, dielectric trench), and extended on the dielectric sidewall **214** and disposed across the entire dielectric structure **210** for electrically connecting the first patterned electrodes **104** separated by the second patterned electrode **106** to each other.

In some embodiments, the conductive bridge **116** may be directly formed by the printing process without using the patterning process, hence largely simplifying the process, shortening production time and increasing production. In addition, since the dielectric structure **210** has the dielectric opening **212** (that is, the dielectric trench), the printing conductive glue for the conductive bridge **116** can be precisely controlled and guided into the dielectric opening **212** in conductive structure. Therefore, the short-circuiting problem caused from the conductive glue being overbanked to unexpected areas can be avoided, and the conductive bridge **116** can have better electrical properties or physical qualities such as uniform width and thickness. In some embodiments, a top surface **226** of the conductive bridge **116** is controlled to be not higher than a top surface of the dielectric structure **210**. For example, the top surface **226** of the conductive bridge **116** is substantially co-planer with the first upper dielectric surface **222** of the dielectric structure **210**, or disposed between the first upper dielectric surface **222** and the second upper dielectric surface **224**. The above structural design avoids the structure that the conductive bridge **116** is protruded from the dielectric structure **210** and would be broken due to the compression stress in subsequent processes such as a lamination or a compression process which provides a compression stress. Therefore, product reliability is improved and conformity rate is increased.

FIG. 3A shows an upper view of a touch structure according to one embodiment. FIG. 3B shows a cross-sectional view of the touch structure of FIG. 3A along BB' line. FIG. 3C shows a cross-sectional view of the touch structure of FIG. 3A along CC' line. The touch structure of FIG. 3A to FIG. 3C is different from the touch structure of FIG. 2A to FIG. 2C in that the dielectric opening **312** of the dielectric structure **310** comprises a dielectric trench **312**A and dielectric holes **312**B communicated to the dielectric trench **312**A. The dielectric trench **312**A is extended towards the inside of the dielectric structure **310** from the first upper dielectric surface **322** and exposes the second upper dielectric surface **324**. The dielectric holes **312**B respectively expose the corresponding first patterned electrodes **104** and the dielectric sidewalls **314**.

Referring to FIG. 3A to FIG. 3C, the conductive bridge **116** is extended on the second upper dielectric surface **324** exposed from the dielectric trench **312**A of the dielectric opening **312**, and extended on the dielectric sidewall **314** exposed from the dielectric holes **312**B so as to cross a partial of the dielectric structure **310** for electrically connecting the first patterned electrodes **104** separated by the second patterned electrode **106** to each other. In one embodiment, the conductive bridge **116** may fully fill the dielectric holes **312**B of the dielectric opening **312**, substantially. Referring to FIG. 3A and FIG. 3C, in the example, for example, a diameter R of the dielectric holes **312**B is smaller than a width W of the dielectric trench **312**A.

In some embodiments, the conductive bridge **116** can be directly formed by the printing process without using the patterning process, hence largely simplifying the process, shortening production time and increasing production. Since the dielectric structure **310** has a dielectric opening **312** each comprising the dielectric trench **312**A and the dielectric holes **312**B, the printing conductive glue for the conductive bridge **116** can be precisely controlled and guided into the dielectric opening **312** in the conductive structure. Therefore, the short-circuiting problem caused from the conductive glue being overbanked to unexpected areas can be avoided, and the conductive bridge **116** can have better electrical properties or physical qualities such as uniform width and thickness and forms excellent electrical connection with the first patterned electrodes **104**. In some embodiments, the top surface **226** of the conductive bridge **116** is controlled to be not higher than the top surface of the dielectric structure **310**. For example, the top surface **226** of the conductive bridge **116** is substantially co-planer with the first upper dielectric surface **322** of the dielectric structure **310**, or disposed between the first upper dielectric surface **322** and the second upper dielectric surface **324**. The above structural design avoids the structure that the conductive bridge **116** is protruded from the dielectric structure **310** and would be broken due to the compression stress in subsequent processes such as a lamination or a compression process which provides a compression stress. Therefore, product reliability is improved and conformity rate is increased.

FIG. 4A shows an upper view of a touch structure according to one embodiment. FIG. 4B shows a cross-sectional view of the touch structure of FIG. 4A along BB' line. FIG. 4C shows a cross-sectional view of the touch structure of FIG. 4A along CC' line. The touch structure of FIG. 4A to FIG. 4C is different from the touch structure of FIG. 3A to FIG. 3C in that the dielectric structure **410** covers all of the first patterned electrodes **104** and the second patterned electrode **106**.

Referring to FIG. 4A to FIG. 4C, the dielectric opening **412** of the dielectric structure **410** comprises a dielectric trench **412**A and dielectric holes **412**B communicated to the dielectric trench **412**A. The conductive bridge **116** is extended on the second upper dielectric surface **424** exposed from the dielectric trench **412**A, and extended on the dielectric sidewall **414** exposed from the dielectric holes **412**B to cross a partial of the dielectric structure **410** for electrically connecting the first patterned electrodes **104** separated by the second patterned electrode **106** to each other. Referring to FIG. 4A, in the present example, for example, the diameter R of the dielectric holes **412**B is larger than the width W of the dielectric trench **412**A.

In some embodiments, the conductive bridge **116** can be directly formed by the printing process without using the patterning process, hence largely simplifying the process, shortening production time and increasing production. Since the dielectric structure **410** has the dielectric opening **412** each comprising the dielectric trench **412**A and the dielectric hole **412**B, the printing conductive glue for the conductive bridge **116** can be precisely controlled and guided into the dielectric opening **412** in the conductive structure. Therefore, the short-circuiting problem caused from the conductive glue being overbanked to unexpected areas can be avoided, and the conductive bridge **116** can have better electrical properties or physical qualities such as uniform width and thickness and forms excellent electrical connection with the first patterned electrodes **104**. The dielectric structure **410**, which covers all of the first patterned electrodes **104** and the second patterned electrode **106**, reduces the likelihood of the short-circuiting problem caused from the conductive glue being overbanked to unexpected areas. In some embodiments, the top surface **226** of the conductive bridge **116** is controlled to be not higher than the top surface of the dielectric structure **410**. For example, the top surface **226** of the conductive bridge **116** is substantially co-planer with the first upper dielectric surface **422** of the dielectric structure **410**, or disposed between the first upper dielectric surface **422** and the second upper dielectric surface **424**. The above structural design avoids the structure that the conductive bridge **116** is protruded from the dielectric structure **410** and would be broken due to the compression stress in subsequent processes such as a lamination or a compression process which provides a compression stress. Therefore, product reliability is improved and conformity rate is increased.

It will be apparent to those skilled in the art that various modifications and variations can be made to the disclosed embodiments. It is intended that the specification and examples be considered as exemplary only, with a true scope of the disclosure being indicated by the following claims and their equivalents.

What is claimed is:

1. A touch structure, comprising:
- first patterned electrodes;
- a second patterned electrode disposed between the first patterned electrodes and separated from the first patterned electrodes;
- a dielectric structure disposed on the first patterned electrodes and the second patterned electrode, wherein the dielectric structure has a dielectric opening; and
- a conductive bridge disposed across the dielectric structure and extended in the dielectric opening, wherein the first patterned electrodes are electrically connected to each other through the conductive bridge.

2. The touch structure according to claim **1**, wherein the dielectric opening comprises a dielectric trench and/or dielectric holes, and the conductive bridge is extended in the dielectric trench and/or the dielectric holes.

3. The touch structure according to claim **2**, wherein the dielectric holes expose the corresponding first patterned electrodes.

4. The touch structure according to claim **2**, wherein the dielectric structure has a first upper dielectric surface and a second upper dielectric surface, the dielectric trench is extended towards an inside of the dielectric structure from the first upper dielectric surface so as to expose the second upper dielectric surface.

5. The touch structure according to claim **2**, wherein the dielectric trench and the dielectric holes are communicated to each other.

6. The touch structure according to claim **1**, wherein the dielectric opening comprises dielectric holes respectively exposing the corresponding first patterned electrodes, and the conductive bridge is extended into the dielectric holes for electrically connecting the first patterned electrodes exposed from the dielectric holes to each other.

7. The touch structure according to claim **1**, wherein
- the dielectric opening comprises a dielectric trench,
- the dielectric structure has a first upper dielectric surface, a second upper dielectric surface and a dielectric sidewall,
- the dielectric trench is extended towards an inside of the dielectric structure from the first upper dielectric surface so as to expose the second upper dielectric surface,
- the conductive bridge is extended on the second upper dielectric surface exposed from the dielectric trench and extended on the dielectric sidewall for electrically connecting the first patterned electrodes to each other.

8. The touch structure according to claim **7**, wherein the dielectric opening further comprises dielectric holes exposing the corresponding first patterned electrodes and exposing the dielectric sidewall on which the conductive bridge is extended.

9. The touch structure according to claim **1**, wherein the dielectric structure covers partial or all of the first patterned electrodes and the second patterned electrode.

10. A manufacturing method of a touch structure, comprising:
- disposing first patterned electrodes on a substrate;
- disposing a second patterned electrode on the substrate, wherein the second patterned electrode is disposed between the first patterned electrodes;
- disposing a dielectric structure on the first patterned electrodes and the second patterned electrode,
- forming a dielectric opening in the dielectric structure; and
- disposing a conductive bridge across the dielectric structure and extending in the dielectric opening, wherein the first patterned electrodes are electrically connected to each other through the conductive bridge.

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